

# A Systematic Review of eHealth Interventions for Healthy Aging: Status of Progress

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**Abstract:** Worldwide, old age population is projected to attain 2 billion by 2050, raising challenges for healthcare, social security, pension and long-term care. Several eHealth interventions have been proposed as promising avenues to support healthy aging (HA), but effectiveness has not been synthesised. This study aims to systematically review the effectiveness of eHealth interventions for HA. We performed standardized searches in relevant databases to identify (quasi)-experimental studies evaluating the effectiveness of eHealth interventions for HA. Outcomes of interest are: wellbeing, quality of life, activities of daily living, leisure activities, knowledge, evaluation of care, social support, skill acquisition and healthy behaviours. We also consider adverse effects such as social isolation, anxiety, and burden on informal caregivers. Two reviewers will independently assess studies for inclusion. Data extraction is based on standardised tools and done independently by two reviewers. An initial search led to 7039 potentially relevant citations. After screening titles and abstract, 60 full text articles were further assessed, of which 12 (presenting 11 studies) were finally retained for the review. Effect sizes related to each type of eHealth intervention will be calculated on the final selection. If not possible, we will present the findings in a narrative form. This systematic review will provide unique knowledge on the effectiveness of eHealth interventions for supporting HA.

## 1 INTRODUCTION

Worldwide, the proportion of people aged over 65 years is projected to attain 2 billion by 2050 (Kinsella and Phillips, 2005). This change, associated with progresses in healthcare but mostly with improvements in living conditions, put aging at the forefront of public concerns. However, population aging also associated with an increase in the prevalence of chronic diseases (Reis et al., 2013), which challenges the sustainability of healthcare and social services delivery (Illario et al., 2015). In view of these challenges, following the World Health Organization (WHO) meeting on healthy aging (World Health Organization, 2002), several initiatives has spurred, among which eHealth Interventions for Healthy Aging.

Healthy aging (HA) is defined as “the process of optimizing opportunities for physical, social and mental health to enable older people to take an active part in society without discrimination and to enjoy an independent and good quality of life” (Swedish National Institute of Public Health, 2006).

HA includes an active engagement with life, optimal cognitive and physical functioning and low risk of disease that enables older people to participate within their limitations and continue to be physically, cognitively, socially and spiritually active (Hansen-Kyle, 2005). People live longer and want to stay active, happier, and healthy although the decline in the biological, physiological and cognitive systems inherent to aging may limit full social, cultural and intellectual engagement in the elderly (Jin et al., 2015). As the first wave of baby-boomers reaches the retirement age, policies are levied to keep seniors active in prolonging the working period in several countries (e.g. Greece, France, Denmark) (Hofäcker, 2014, Hofäcker and Naumann, 2015). This cohort and onward generations in the “early old age” (50 years and above) use e-tools in their daily activities (Pew research Center, 2014). Ensuring HA for the population is thus a priority in developed countries, but also in developing countries that foresee aging of their population in a near future (Henriquez-Camacho et al., 2014).

eHealth is an overarching term that encompasses

the various uses of Information and Communication Technology (ICT) and web-driven application in the sphere of health care and health promotion, such as telemedicine, electronic health records, virtual interventions and personal health monitoring. With respect to HA, eHealth applications offer older adults the opportunity to access health information and receive health and social care in their homes. These interactive interventions can empower, engage, and educate older adults (Hall et al., 2012). eHealth interventions are among the promising avenue and receive increasing attention because of their potential to support a healthy life and the recognition of their central role in today's society. In synthesizing the latest updates, Lattanzio et al. highlight three main domains of development related to eHealth innovation: (1) disease management, (2) intelligent devices to address mobility risks (i.e., falls in elders), and (3) specific needs for HA (Lattanzio et al., 2014). In total, they are designed for virtual physical exercise (Silveira et al., 2013, Wu and Keyes, 2006) — wirelessly or not—, to promote social networking (Rébola, 2015), lifestyle (Cook et al., 2015); smartphone application are developed to support elderly autonomy (Willner et al., 2015). Interestingly, recent studies contended a high intention to adopt e-tools among older adults (Rosella et al., 2014) as well as a recognition of their safety (Heinbuchner et al., 2010, Londei et al., 2009), and their relevance (Mihailidis et al., 2008). Some other reported that they are adapted and usable and offer independence and confidence (Brownsell and Hawley, 2004).

eHealth is evolving rapidly. In the first quarter of 2014 the number of health and wellbeing apps has reached the cape of 100.000 (Research2guidance, 2014), targeting predominantly chronically ill patients (31%) and health and fitness-interested people (28%). Approximately, 500 million smartphone users worldwide will be using a healthcare application by the end of 2015. A substantial part of them are senior clients using these applications to help themselves to stay fit, monitor their own health status or keep in contact with their healthcare provider. In contrast to the growing use of eHealth to support HA, knowledge about effective technologies and interventions for HA is clearly absent. Decision makers need evidence on effective strategies that could be implemented in order to maximize health and wellbeing of older adults.

## 2 OBJECTIVES

This systematic review intends to shed light on the

promise of eHealth interventions in promoting HA among older adults. This project targets two main objectives: 1) to identify and systematically summarize the best available evidence on the effectiveness of eHealth interventions on HA; 2) to explore how specific eHealth interventions (age-friendly, community intervention, public policies) and their characteristics (e.g.: mode of implementation) may be implemented to effectively impact HA.

## 3 METHODS

We are conducting a systematic review of the literature based on the Cochrane Collaboration methods (Higgins and Green, 2011).

### 3.1 Types of Participants

This review considers studies that include male and female adults aged 50 or more (as 50 years is generally set as the beginning of the young old age (Swedish National Institute of Public Health, 2006), living in the community or in institutional arrangement (e.g. nursing home), and who were offered any intervention using eHealth for HA. Exclusion criteria: 1) People with a terminal illness; hospitalized in-patients; 2) Older adults with severe impaired cognition, as measured by the Mini Mental State Examination (Folstein et al., 1975)

### 3.2 Types of Interventions

This review consists of studies that evaluate interventions on HA as defined above, and delivered through eHealth, including teleHealth and telemedicine, remote monitoring, internet, mobile smart phones, interactive digital games, electronic information systems. The interventions may take place at home, in a community health center or another relevant setting. The interventions may be delivered individually or in groups. The interventions may last one or more sessions of various time frames. Exclusion criteria: Interventions that include an important face-to-face component; Interventions using conventional telephone, television or radio; Interventions using technologies without an interactive component; Interventions targeting treatment, or prevention of complications of health problems.

### 3.3 Types of Outcomes

This review considers studies that include one or

more of the following outcome measures as defined by the “Outcomes of interest to the Cochrane consumers & communication review group” (Cochrane Consumers in Communication Review Group, 2012). Primary outcomes include: wellbeing, quality of life, activities of daily living, leisure activities, biological measures, health-enhancing lifestyle, self-efficacy, and other related outcomes.

Secondary outcomes include: 1) knowledge and understanding; 2) Participant decision-making including decision made and satisfaction with decision taken; 3) Evaluation of care including goal attainment; 4) social support; 5) skills acquisition 6) health behavior including adherence to treatment and screening; and 7) other relevant outcomes. This study will also consider adverse effects related to eHealth interventions on HA in the targeted population. Adverse effects may include: social isolation, anxiety, burden on informal caregivers.

### 3.4 Types of Studies

The review includes any experimental study design including randomized controlled trials, non-randomized controlled trials; and quasi-experimental, before and after studies for inclusion.

Studies published from 2000 up to 2015 in English, Dutch, French or Spanish are considered for inclusion.

### 3.5 Search Strategy

The search strategy aims to find both published and unpublished studies. A three-step search strategy was used. An initial exploratory search of Medline and CINAHL was undertaken followed by an analysis of the words contained in the title and abstracts, and of the keywords and index terms used to describe articles. A second search using all identified keywords and index terms was then undertaken across all included databases. Thirdly, after removing duplicates from the reference manager Endnote, 7039 reference were obtained and are under the first round of screening to map out those fitting the inclusion criteria. Further, references list of included studies will be screened for additional studies.

A final search is planned once ready to draft the manuscript to identify any new relevant studies on the topic. The search strategy (table 1) was adapted and conducted in the following databases: CINAHL, Cochrane Library, Embase, Eric, Campbell Collaboration Library, PsycINFO, Web of Science, and Social Work Abstracts.

### 3.6 Assessment of Methodological Quality

Studies selected for retrieval were assessed by two independent reviewers (IB & PV) for methodological quality prior to inclusion in the review using the Cochrane Risk of Bias tool (Higgins and Green, 2011). The disagreements that arose between the reviewers were resolved through discussion with a third reviewer (MPG or RB).

### 3.7 Data Extraction

Data will be extracted from studies included in the review using a standardized data extraction tool based on our previous reviews. The data extracted will include specific details about the interventions, populations, study methods and outcomes of significance to the review question and specific objectives. If needed, we will contact authors of primary studies for missing information or to clarify unclear data.

### 3.8 Data Synthesis

Where possible, data will be pooled in statistical meta-analysis. Effect sizes expressed as odds ratio (for categorical data) and weighted mean differences (for continuous data) and their 95% confidence intervals will be calculated for analysis. Heterogeneity will be assessed statistically using the standard Chi-square and also explored using subgroup analyses based on the different study designs included in the review. If statistical pooling is not possible, we will present the findings in a narrative form. We will undertake a qualitative analysis of the descriptions of the interventions, as provided in each report, to detail the interventions components, inspired from the taxonomy of interventions developed by EPOC (Effective Practice and Organisation of Care (EPOC), 2015).

## 4 RESULTS

Figure 1 presents the flow diagram of the systematic review. We have already conducted initial searches in bibliographic databases and retrieved 7039 citations. After initial screening of titles and abstracts, 60 publications were kept for further evaluation. The study selection led to a final sample of 12 publications describing 11 studies (see figure 1). Data extraction from selected studies will be done from February to

Table 1: Search strategy used in OVID-Medline ®.

No	Concept equations
1	("active ageing" or "active aging" or "Healthy ageing" or "Healthy aging" or Aging or "Middle Aged" or Aging or Ageing or old or elder* or senior).ab,ti.
2	Middle Aged.mp. or exp Middle Aged/ or exp Aging/ or exp Aged/
3	1 or 2
4	(Project or program or Support or programme or intervention or "Health Education" or "Health Promotion" or "Occupational Health Services" or "Health Services for the Aged" or "Preventive Health Care" or "Primary Prevention").ab,ti.
5	Health Education.mp. or exp Health Education/ or Health Promotion.mp. or exp Health Promotion/ or Occupational Health Services.mp. or exp Occupational Health Services/ or Health Services for the Aged.mp. or exp Health Services for the Aged/ or Primary Prevention.mp. or exp Primary Prevention/ or Occupational Health Nursing.mp. or exp Occupational Health Nursing/
6	4 or 5
7	("Health Communication" or Telenursing or Tele-nursing or "Health Informatics" or "Information Technology" or "Information Technology Personnel" or internet or "World Wide Web" or Smartphone or online or on-line or web-based or "web based" or webbased or "remote monitor*" or "interactive digital game" or "electronic information system" or "Computer-Assisted" or "Computerized Health Record" or Telemedicine or Tele-medicine or TeleHealth or TeleHealth or "Mobile health" or "Remote Consultation" or "Electronic Health Records" or "Public Health Informatics" or "personal digital assistant").ab,ti.
8	Health Communication.mp. or exp Health Communication/ or exp Remote Consultation/ or Telenursing.mp. or exp Telemedicine/ or exp Telenursing/ or exp Internet/ or exp Medical Informatics/ or Information Technology.mp. or Information Technology Personnel.mp. or smartphone.mp. or exp Cell Phones/ or exp Electronic Health Records/ or Computerized Health Record.mp. or TeleHealth.mp. or Public Health Informatics.mp. or exp Public Health Informatics/
9	7 or 8
10	Health Education.mp. or exp Health Education/ or exp Health Behavior/ or exp Health Knowledge, Attitudes, Practice/ or Health Knowledge.mp. or Quality of Life.mp. or exp "Quality of Life"/ or Self Efficacy.mp. or exp Self Efficacy/ or Social Support.mp. or exp Social Support/ or Life Style.mp. or exp Life Style/ or Health Literacy.mp. or exp Health Literacy/ or Risk Reduction Behavior.mp. or exp Risk Reduction Behavior/
11	("Health Knowledge" or "Health Behavior" or "Quality of Life" or "Self-Efficacy" or "Social Support" or "Life Style" or "health education" or "health knowledge attitude and practice" or "health Attitude" or "Health Literacy" or "Health Behaviour" or "Quality of Life" or "psychco-Social Support" or "Risk Reduction Behavior").ab,ti.
12	10 or 11
	3 and 6 and 9 and 12

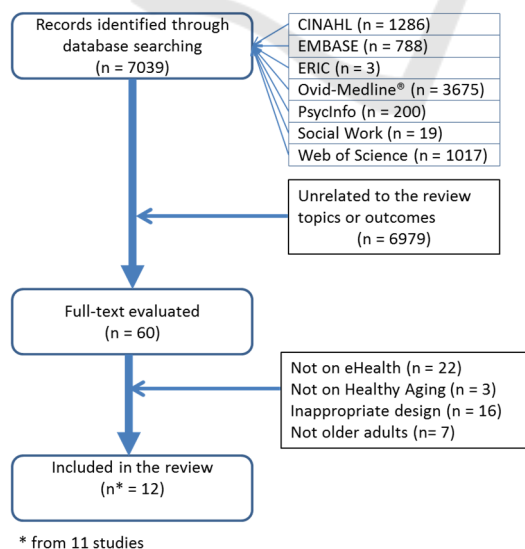


Figure 1: Study selection and flow diagram.

March 2016, and data synthesis will be completed in May 2016.

## 5 CONCLUSIONS

Aging population is a worldwide topical issue and eHealth a promising resource to address this raising challenge. This review, first of its kind, will shed light on eHealth as promising resource to support HA. The findings from this systematic review stemmed from salient eHealth interventions implemented will engender insight regarding the role of eHealth to answer the increasing needs of an aging population. The findings will offer possible alternatives for better policy making option for HA.

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